

1 CLAIMS

2 What is claimed is:

- 3 1. A computer-implemented method for determining routing
4 feasibility of a plurality of nets, each net having an
5 associated set of one or more routing solutions, each
6 solution using one or more routing resources, comprising:
7 generating a first Boolean function with variables
8 representing respective net/solution pairs, wherein the
9 first function evaluates to true if there exists a set of
10 values for the variables such that at least one of the
11 variables for each net is logically true;
12 generating a second Boolean function using the
13 variables that represent the net/solution pairs, wherein the
14 second function evaluates to true if there exists at least
15 one set of values for the variables such that no resource is
16 used by more than a predetermined number of nets; and
17 outputting a signal indicating whether there exists at
18 least one set of values for the variables for which the
19 first function and the second function evaluate to true.
20
21 2. The method of claim 1, further comprising representing
22 the first and second Boolean functions in conjunctive normal
23 form.
24
25 3. The method of claim 2, further comprising applying
26 Boolean satisfiability to first and second functions.
27
28 4. The method of claim 1, wherein the resources comprise
29 signal routing resources of a field programmable gate array.
30
31 5. The method of claim 1, further comprising generating a
32 net table including respective sets of solutions associated
33 with the nets.
34
35 6. The method of claim 5, further comprising generating
36 the first function from the net table.

1
2 7. The method of claim 5, further comprising generating a
3 resource table including respective sets of net/solution
4 pairs associated with the resources, wherein each
5 net/solution pair associated with a resource represents
6 usage of the resource by the net/solution pair.

7
8 8. The method of claim 7, further comprising generating
9 the second function from the resource table.

10
11 9. The method of claim 1, wherein the predetermined number
12 of nets that can use a resource is 1.

13
14 10. The method of claim 1, further comprising saving as a
15 routing solution the at least one set of values for the
16 variables for which the first function and the second
17 function evaluate to true.

18
19 11. The method of claim 1, wherein if there exists no set
20 values for the variables for which first and second
21 functions evaluate to true, then performing the steps of:

22 modifying one or more selected sets of the routing
23 solutions; and

24 repeating the steps of generating first and second
25 functions and outputting the signal.

26
27 12. The method of claim 11, further comprising adding
28 additional sets of routing solutions.

29
30 13. The method of claim 12, wherein the repeating step
31 continues until predetermined criteria are met.

32
33 14. An apparatus for determining routing feasibility of a
34 plurality of nets, each net having an associated set of one
35 or more routing solutions, each solution using one or more
36 routing resources, comprising:

1 means for generating a first Boolean function with
2 variables representing respective net/solution pairs,
3 wherein the first function evaluates to true if there exists
4 a set of values for the variables such that at least one of
5 the variables for each net is logically true;

6 means for generating a second Boolean function using
7 the variables that represent the net/solution pairs, wherein
8 the second function evaluates to true if there exists at
9 least one set of values for the variables such that no
10 resource is used by more than a predetermined number of
11 nets; and

12 means for outputting a signal indicating whether there
13 exists at least one set of values for the variables for
14 which the first function and the second function evaluate to
15 true.

16
17 15. A computer-implemented method for determining routing
18 feasibility of a plurality of nets sharing a plurality of
19 resources, comprising:

20 inputting respective sets of one or more solutions
21 associated with the plurality of nets, each solution being
22 associated with one or more required resources

23 assigning respective identifiers to net/solution pairs;

24 generating respective Boolean liveness functions for
25 the nets using the net/solution pairs;

26 generating respective Boolean exclusivity functions
27 using the net/solution pairs for each resource required by
28 two or more nets;

29 generating a routability Boolean function as a logical
30 AND of the liveness functions and exclusivity functions; and

31 testing whether the routability function can be
32 satisfied.

33
34 16. The method of claim 15, further comprising generating a
35 net table including respective sets of solutions associated
36 with the nets.

